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A dichotomy between the hard state spectral properties of black hole and neutron star X-ray binaries

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Abstract

© 2016 The Authors. We analyse the spectra of black hole (BH) and neutron star (NS) X-ray binaries (XBs) in the hard state using archival RXTE observations. We find that there is a clear dichotomy in the strength of Comptonization between NS and BH sources, as measured by both the Compton y-parameter and the amplification factor A, with distinct groups of BH and NS XBs separated at y ~ 0.9 and A ~ 3. The electron temperature kT e can occupy a broad range in BH systems, from kT e ~ 30 to 200 keV, whereas for NSs kT e is peaked at ~15-25 keV, but can extend to higher values. The difference between BHs and NSs in y implies that kT e is higher at a given optical depth for BH XBs. Our results also imply that for NS systems the accreting material loses ~1/2-2/3 of its energy through Comptonization in the corona. The remaining energy is released on the surface of the NS, making it a powerful source of soft radiation, which alters the properties of the Comptonizing corona. Finally, we find evidence at the~2.4σ confidence level that Comptonization parameters may be correlated with the NS spin, whereas no correlation with the BH spin is found. Our results highlight a further observational distinction between BH and NS XBs, which is a consequence of NSs possessing a physical surface.

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Keywords

Accretion, Accretion discs, Radiation mechanisms: general, Stars: neutron, X-rays: binaries

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